Wisconsin
Department of Commerce

Evaluation # 200216-O

Safety & Buildings Division
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Wisconsin
Building Products Evaluation

Material	Bertsche System "Concealed Forged Steel Heavy Timber Connection System"
Manufacturer	Bertsche System TafertsbergstraBe 5 94267 Prackenbach, Germany

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of the Bertsche System "Concealed Forged Steel Heavy Timber Connection System through a review of structural performance of the concealed steel connections and class of construction for "Type 6 Metal Frame/Unprotected" buildings.

This review includes the cited **Comm** code requirements below in accordance with the current **Wisconsin Building and Heating, Ventilating and Air conditioning Code:**

- **Structural:** The Bertsche System "Concealed Forged Steel Heavy Timber Connection System was evaluated for use in accordance with the structural requirements of **ss. Comm 53.01**, **53.10**, **53.11**, **53.12**, **53.61(8)** and **53.62**.

- **Construction Class:** The Bertsche System "Concealed Forged Steel Heavy Timber Connection System was evaluated for use under class of construction "Type 6 Metal Frame/Unprotected", **s. Comm 51.03(6)** and **TABLE 51.03-A**.

This review includes the cited **International Building Code (IBC)** requirements below in accordance with the **Wisconsin Amended IBC Code (effective 7/01/02):**

- **Structural:** The Bertsche System "Concealed Forged Steel Heavy Timber Connection System was evaluated for use in accordance with the structural requirements of **ss. IBC 1603.1.3**, **1606.1**, **1607.1**,

1607.11, **1607.11.1**, **1607.11.2**, **1607.11.2.1**, **s. 1608**, **1609**, **1704.3** and **Exception 1.**, **IBC 2209.1**, **2303.1**, **2303.1.3**, **2303.1.8**, **2303.1.9**, **2303.2.**, **2303.2**, **2304.9.4**, **2304.10.3**, and **2306.1**.

- **Construction Class:** The Bertsche System "Concealed Forged Steel Heavy Timber Connection System was evaluated for use under types of construction in accordance with **ss. IBC 601**.

DESCRIPTION AND USE

General: The BVD Hanger Joint System was developed in Germany to connect GLULAM structure construction at all the superstructure connections. The system has two main components: 1) the BVD Hanger and 2) The Drift pins. Grout is used to fill the space between the hanger, the Drift pins, and the wood. **See Figure 1**, **Figure 2**, and **Figure 3**

BVD COMPONENTS:

The **BVD Main Connector Hanger:** is a steel bar with holes for Drift pins .6250-inch diameter (16 mm). The Drift pins are pair-wise installed in the member at least one pair horizontally and one pair vertically. For larger hangers, there are six pairs horizontally and six pairs vertically. The head of the hanger has an inside thread. Six different hanger sizes are available (Type BVD 1 through BVD 6), each size with a different load bearing capacity depending on the number of drift pins.

Table 1 - Dimensional Specifications

BVD – anchors		**BVD 1**	**BVD 2**	**BVD 3**	**BVD 4**	**BVD 5**	**BVD 6**
Inner thread		M 20	M 30	M 30	M 36	M 42	M 42
Depth of penetration	[mm]	21 ± 5	30 ± 5	30 ± 5	36 ± 5	42 ± 5	42 ± 5
Length	[mm]	185	311	411	511	606	706
Outside diameter	[mm]	49	58	63	63	68	68
Depth of the cut hole	[mm]	215	340	445	545	645	745
Diameter of the cut hole	[mm]	51	61	66	66	71	71
Number of pins	Pieces	4	8	12	16	20	24
Consumption of BVD-grout	[kg]	0,51	0,76	0.98	1,33	1,58	1,92
Pieces p. 25 kg of grout	Pieces	~ 49	~ 33	~ 25	~ 18	~ 15	~ 13

Weight	[kg]	1,184	4,310	7,250	8,350	11,420	13,210

The **Drift Pins** and the **BVD-threaded Washers:** The pins are .6250-inch diameter (16 mm). The table below shows the number of drift pins needed for any BVD main connector and BVD threaded washers when necessary.

Table 2

Fitting to BVD Main Connector		**BVD 1**	**BVD 2**	**BVD 3**	**BVD 4**	**BVD 5**	**BVD 6**
Pins							
Number		4	8	12	16	20	24
Diameter	[mm]	16	16	16	16	16	16
Length	The length of the pins depend on the wood cross-section						
BVD-Threaded Washer		KL 35/8		KL 45/8			
Outside Diameter	[mm]	35		45			
Width	[mm]	8		8			
Weight	[kg]	0,046		0,086			
Inner Thread		M 16		M 16			

The **Screws:** The following table shows the geometrical values of the screws depending on the BVD main connector types.

Table 3

Fitting to BVD Main Connector		**BVD 1**	**BVD 2**	**BVD 3**	**BVD 4**	**BVD 5**	**BVD 6**
Screws	Hexagonal Bolts Following DIN 912						
Thread M		M 20	M 30		M 36	M 42	
Nominal Length L	[mm]	50	70		90		
Normal Quality		8.8		10.9			
Weight ca.	[kg]	0,185	0,638		1,122	1,640	

In exceptional cases higher steel qualities may be necessary.

The **BVD-Welding Box and the the BVD Main Connector Block with Circular slots:** The three following tables show the sizes of the BVD-spherical washers and the fitting BVD main connector blocks.

The **Die BVD-Spherical Washer:**

The **BVD-Welding Box:**

Table 4

		SB 20	**SB 30**	**SB 36**	**SB 42**
Fitting to BVD Main Connectors		BVD 1	BVD 2 u. 3	BVD 4	BVD 5 u. 6
Edge Length B 1	[mm]	50	70	80	90
Height of the body B 2	[mm]	20	25	30	30
Head drill hole diameter D 1	[mm]	41	64	70	80
Body drill hole diameter D 2	[mm]	24	34	41	48
Chamfer (= thickness of the welded joint a_w	[mm]	5	8	8	10
Radius R	[mm]	27	41	50	58
Weight	[kg]	0,623	1,468	2,220	3,040

The **BVD Main Connector Block with Circular Slot:** The following table show the standardized sizes of the BVD main connector blocks with circular and parallel slots.

Table 5

		AN 12	**AN 16**	**AN 20**	**AN 30**	**AN 36**	**AN 42**
Fitting to BVD Main Connectors				BVD 1	BVD 2 u. 3	BVD 4	BVD 5 u. 6
Length B 1	[mm]	24	31	45	63	72	82
Depth of the hole B 2	[mm]	8	10	15	18	22	22
BVD-ring plate distance B 3	[mm]	30	40	50	70	80	90
Breath B 4	[mm]	36	44	50	76	88	100
Depth B 5	[mm]	55	60	82	110	138	160
Ø Drilling D 1	[mm]	28	35	40	60	70	78
Ø Drilling D 2	[mm]	16	20	24	34	41	48
Radius R	[mm]	17	22	27	41	50	58
Breath of groove NB	[mm]	6	6	10	14	17	22

Depth of groove NT	[mm]	6	7	10	10	12	15
Curve of the groove ØRSD 2	[mm]	100	125	160	240	275	310
Weight	[kg]			1,113	2,780	4,520	6,52

The **BVD-Ring Plate:** The BVD-ring plates types R S 12 through R S 42.

Table 6

		RS 12	**RS 16**	**RS 20**	**RS 30**	**RS 36**	**RS 42**
Fitting to BVD Main Connectors				BVD 1	BVD 2 u. 3	BVD 4	BVD 5 u. 6
Outside diameter ØRSD 1	[mm]	190	265	300	450	520	580
Inside diameter ØRSD 2	[mm]	100	125	160	240	275	310
Width RSt	[mm]	4	4	8	12	15	20
Weight	[kg]	0,656	1,337	3,237	10,925	18,357	30,197

The **BVD-Reduction Washers:**

Table 7

		SM 30/20	**SM 42/30**	**SM 42/36**
Fitting to BVD Main Connectors		BVD 1	BVD 2 u. 3	BVD 4
Outside diameter Ød(a)	[mm]	44	68	68
Inside diameter Ød(i)	[mm]	21	31	37
Width t	[mm]	8	10	10
Following DIN		7349	7349	-
Weight	[kg]	0,102	0,050	0,110

Sealing with BVD-Grout:

The BVD-grout is a grout on cement basis following a special prescription, proprietary to Bertsche.

Table 8

Grain size		0 – 1,25 mm
Fließmaß		70 cm
Quellmaß		+ 0,8 Vol. %
Druckfestigkeit	nach 24 Stunden	47 N/mm^2
	nach 28 Tagen	90 N/mm^2
	nach 90 Tagen	kein Festigkeitsabfall
Biegezugfestigkeit	nach 24 Stunden	7,4 N/mm^2
	nach 28 Tagen	15,3 N/mm^2
	nach 90 Tagen	kein Festigkeitsabfall
Wasser / Feststoffwert ca.		0,15
Verarbeitungszeit ca.		30 min.
Mischzeit		> 3 min.

Spezifisches Gewicht	2250 g/dm^3

The instructions on the wrapping shall be followed.

The **Lateral Metal Plates:** Depending on the load the lateral metal plates are plane plates of St 37 or St 52.

The **BVD-Spherical Node:**

Table 9

		KK1	KK2	KK3
Outside diameter of the bowl ØD	[mm]	250	300	400
Thickness of the bowl membrane t	[mm]	12	25	25
Diameter of the open hole Ød(1)	[mm]	100	150	120
Material		GS-52 / GGG-42		

The allowable loads are calculated following steel design or by testing.

The **BVD-Restauration Anchor:**

Table 10

		SA 25
Round steel diameter d	[mm]	25
Total length L	[mm]	830
Plate thickness t	[mm]	15
Plate diameter d(1)	[mm]	58
Diameter of the shaped hole	[mm]	60
Depth of the shaped hole L/2	[mm]	440
Weight	[kg]	4,560
Fitting pin	[mm]	12
Fixed value for calculation of the lateral wood K		20,9
Admisible load out of steel and grout	[kN]	140,4

The **BVD-End Grain Timber Connector:**

The table shows three different connection types.

Table 11

Screw connection M		M 12	M 16	M 20
Height H	[mm]	35	40	50
Breath B	[mm]	25	30	35

Width of flange S	[mm]	3	4	5
Height of the vertical plate t	[mm]	12	15	20
Radius r	[mm]	1,0	1,5	2,0
Minimum hole distance e l ≥ 1,8 * d	[mm]	22	29	36
Minimum hole distance e 2 ≥ 4,0 * d	[mm]	48	64	80
Minimum wood length l v ≥ 12 * d	[mm]	144	192	240

Accessories:

1. Threaded rod M 12, M 16 bzw. M 20 with length as needed.
2. Special screws may be ordered.

The **BVD-Shear Connector:**

There are four steps in installing the BVD Hanger System:

1. Drilling the pin holes.
2. Drilling respectably molding a hole into the end-grain of the wood.
3. Install the hangers and Drift pins.
4. Fill in the grout into the space between the hanger, pins, and the wood. Due to the enough play by the pocket of the hanger, the hanger can be adjusted before grouting. **See Figure 2**, and **Figure 3**

The **Glulam:** made up of wood laminations, or "lams" that are bonded together with adhesives. The grain of all laminations run parallel with the length of the member. Individual lams typically are 1-3/8-inches thick for Southern Pine and 1-1/2-inches thick for Western Species, although other thickness may also be used. Glulam products typically range in net widths from 2-1/2 to 10-3/4 inches, virtually any member width can be custom produced.

An engineered product, glued laminated timbers are manufactured to meet a range of design stresses. Beams are manufactured with the strongest lams on the bottom and top of the beam, where maximum tension and compression stresses occur.

Balanced and Unbalanced Beams: Glulams may be manufactured as unbalanced or balanced members. Unbalanced beams have different bending stresses assigned to the compression and tension zones and must be installed accordingly. To assure proper installation of unbalanced beams, the top of the beam is clearly stamped with the word "TOP." Unbalanced beams are primarily intended for simple span applications.

Balanced members are symmetrical in lumber quality about mid-height. Balanced beams are used in applications such as cantilevers or continuous spans, where either the top or bottom of the member may be stressed in tension due to service loads. They can also be used in single span applications, although an unbalanced beam is more efficient.

Allowable Design Properties: Allowable design properties, a key factor in specifying glulam. Bending members are typically specified on the basis of the maximum allowable bending stress of the member. Different stress levels are achieved by varying the percentages and grade of higher quality lumber in the beam lay-up. Use of different species may also result in different stress designations.

The beam used with the Bertsche System "Concealed Forged Steel Heavy Timber Connection System are usually custom members. Custom members are available in any size and shape required to meet the design conditions.

Figure 1

Figure 2

Figure 3

TESTS AND RESULTS

The tests and results listed below cover both the current WI Building Code **Comm** and future **IBC** requirements.

Structural: The Bertsche System "Concealed Forged Steel Heavy Timber Connection System**:** On file with department, a copy of the German standard DIN 1052, Part 1 and Part 2 (English translation). DIN 1052 Part 1 discusses Structural Use of Timber, Design and Construction. DIN 1052 Part 2 discusses Structural Use of Timber, Mechanically Fastened Joints.

Note: In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Test to approve the load bearing capacity of the BVD Connection was submitted and is on file with the department. The test addressed the bending strength of the glulam, tensile strength capacity of the BVD Hanger System, and load bearing capacity of the connection.

The Bertsche-System-Connectors for timber construction in accordance with the general "Bauaufsichtlichen Zulassung (admission) Z.9.1-233" dated July 29, 1998.

Allowable tensil force alw_Nt of the Bertsche-system-Connectors in the loading case H (according to DIN 1052); shift modules C; Net wood section An; pin-diameter 16 mm (about 5/8''). For further design references see footnotes 1 through 11.

The
BERTSCHE-SYSTEM-Connectors
Types BVD1, BVD2, BVD3, BVD4, BVD5, BVD6
For Timber Construction

Design-Table for BERTSCHE-SYSTEM-Connectors
(Allowable Stress Design)

- Allowable tensile force **alw_Nt** of the BERTSCHE-SYSTEM-Connectors;
- Shift modules **C** ; -Net cross-section $\mathbf{A_n}$ in the connection area.

References: Allgemeine Bauaufsichtliche Zulassung (admission) Z.9.1-233, 29.07.1998;
German Standard DIN 1052.

The pins can be arranged with or without threaded washers.

Table 12 - Design-Table for BERTSCHE-SYSTEM-Connectors

BVD-	Timber cross-section	Timber cross-section	Allowable Tensile Force	Shift Modulus	Timber Net cross-section	Timber Net cross-section
conn.	width	height	tensile force			
type	**b**	**h**	**Alw_Nt**	**C**	**An**	**An**
(K-type)	= pin-	= pin-	connector		**without**	**with**
BVD	length **L 1**	length **L 2**	**loading case H**		threaded washer	threaded washer
	[in.]	[in.]	[lb.]	[lb / ft]	[in^2]	[in^2]
1	4	4	5429	3.97E06	8.47	6.77
2	4	4	8903	6.51E06	7.90	6.19
3	4	4	13107	9.59E06	7.29	4.64
4	4	4				
5	4	4				
6	4	4				
1	4 ½	4 ½	6415	4.69E06	11.86	10.15
2	4 ½	4 ½	10874	7.95E06	11.28	9.58
3	4 ½	4 ½	16064	1.18E07	10.68	8.03
4	4 ½	4 ½				
5	4 ½	4 ½				
6	4 ½	4 ½				
1	5	5	7400	5.41E06	15.74	14.04
2	5	5	12845	9.40E06	15.17	13.46
3	5	5	19021	1.39E07	14.56	11.91
4	5	5	23247	1.70E07	14.56	11.91
5	5	5				
6	5	5				
1	5 ½	5 ½	8386	6.13E06	20.12	18.42
2	5 ½	5 ½	14816	1.08E07	19.55	17.85
3	5 ½	5 ½	21977	1.61E07	18.95	16.30
4	5 ½	5 ½	26861	1.96E07	18.95	16.30
5	5 ½	5 ½	30027	2.20E07	18.42	15.77
6	5 ½	5 ½				
1	6	6	9371	6.86E06	25.01	23.30
2	6	6	16787	1.23E07	24.43	22.73
3	6	6	24934	1.82E07	23.83	21.18
4	6	6	30475	2.23E07	23.83	21.18
5	6	6	34298	2.51E07	23.20	20.65

6	6	6				
1	6 ½	6 ½	10357	7.58E06	30.39	28.69
2	6 ½	6 ½	18758	1.37E07	29.82	28.11
3	6 ½	6 ½	27891	2.04E07	29.21	26.56
4	6 ½	6 ½	34089	2.49E07	29.21	26.56
5	6 ½	6 ½	38568	2.82E07	28.69	26.04
6	6 ½	6 ½	44502	3.26E07	28.69	26.04
1	7	7	11343	8.30E06	36.28	34.57
2	7	7	20730	1.52E07	35.70	34.00
3	7	7	30847	2.26E07	35.10	32.45
4	7	7	37702	2.76E07	35.10	32.45
5	7	7	42839	3.13E07	34.57	31.92
6	7	7	49430	3.62E07	34.57	31.92

Table 12 - Design-Table for BERTSCHE-SYSTEM-Connectors, continued

BVD-	Timber cross-section	Timber cross-section	Allowable Tensile Force	Shift Modulus	Timber Net cross-section	Timber Net cross-section
conn.	width	height	tensile force			
type	**b**	**h**	**Alw_Nt**	**C**	**An**	**An**
(K-type)	= pin-	= pin-	connector		**without**	**with**
BVD	length **L 1**	length **L 2**	**loading case H**		threaded washer	threaded washer
	[in.]	[in.]	[lb.]	[lb / ft]	[in^2]	[in^2]
1	7 ½	7 ½	12328	9.02E06	42.66	40.95
2	7 ½	7 ½	22701	1.66E07	42.09	40.38
3	7 ½	7 ½	33804	2.47E07	41.48	38.83
4	7 ½	7 ½	41316	3.02E07	41.48	38.83
5	7 ½	7 ½	47110	3.45E07	40.95	38.80
6	7 ½	7 ½	54357	3.98E07	40.95	38.80
1	8	8	13314	9.74E06	49.54	47.84
2	8	8	24672	1.80E07	48.97	47.26
3	8	8	36761	2.69E07	48.37	45.71
4	8	8	44930	3.29E07	48.37	45.71
5	8	8	51381	3.76E07	47.84	45.19
6	8	8	59285	4.34E07	47.84	45.19
1	8 ½	8 ½	14299	1.05E07	56.93	55.22
2	8 ½	8 ½	26643	1.95E07	56.35	54.65
3	8 ½	8 ½	39717	2.91E07	55.75	53.10
4	8 1/2	8 ½	48543	3.55E07	55.75	53.10
5	8 ½	8 ½	55651	4.07E07	55.22	52.57
6	8 ½	8 ½	64213	4.70E07	55.22	52.57
1	8 ¾	8 ¾	14792	1.08E07	60.81	59.10
2	8 ¾	8 ¾	27628	2.02E07	60.23	58.53
3	8 ¾	8 ¾	41196	3.01E07	59.63	56.98
4	8 ¾	8 ¾	50350	3.68E07	59.63	56.98
5	8 ¾	8 ¾	57787	4.23E07	59.10	56.45
6	8 ¾	8 ¾	66677	4.88E07	59.10	56.45
1	9	9	14900	1.09E07	64.81	63.11
2	9	9	28614	2.09E07	64.24	62.53
3	9	9	42674	3.12E07	63.63	60.98
4	9	9	52157	3.82E07	63.63	60.98

5	9	9	59922	4.38E07	63.11	60.46
6	9	9	69141	5.06E07	63.11	60.46
1	9 ¼	9 ¼	14900	1.09E07	68.94	67.24
2	9 ¼	9 ¼	29600	2.17E07	68.37	66.66
3	9 ¼	9 ¼	44152	3.23E07	67.76	65.11
4	9 ¼	9 ¼	53964	3.95E07	67.76	65.11
5	9 ¼	9 ¼	62057	4.54E07	67.24	64.59
6	9 ¼	9 ¼	71605	5.24E07	67.24	64.59
1	9 ½	9 ½	14900	1.09E07	73.20	71.49
2	9 ½	9 ½	29799	2.18E07	72.62	70.92
3	9 ½	9 ½	44699	3.27E07	72.02	69.37
4	9 ½	9 ½	54632	4.00E07	72.02	69.37
5	9 ½	9 ½	64192	4.70E07	71.49	68.84
6	9 ½	9 ½	74068	5.42E07	71.49	68.84

Table 12 - Design-Table for BERTSCHE-SYSTEM-Connectors, continued

BVD-	Timber cross-section	Timber cross-section	Allowable Tensile Force	Shift Modulus	Timber Net cross-section	Timber Net cross-section
conn.	width	height	tensile force			
type	**b**	**h**	**Alw_Nt**	**C**	**An**	**An**
(K-type)	= pin-	= pin-	connector		**without**	**with**
BVD	length **L 1**	length **L 2**	**loading case H**		threaded washer	threaded washer
	[in.]	[in.]	[lb.]	[lb / ft]	[in^2]	[in^2]
1	9 ¾	9 ¾	14900	1.09E07	77.57	75.87
2	9 ¾	9 ¾	29799	2.18E07	77.00	75.30
3	9 ¾	9 ¾	44699	3.27E07	76.40	73.75
4	9 ¾	9 ¾	54632	4.00E07	76.40	73.75
5	9 ¾	9 ¾	64565	4.72E07	75.87	73.22
6	9 ¾	9 ¾	74499	5.45E07	75.87	73.22
1	10	10	14900	1.09E07	82.08	80.37
2	10	10	29799	2.18E07	81.51	79.80
3	10	10	44699	3.27E07	80.90	78.25
4	10	10	54632	4.00E07	80.90	78.25
5	10	10	64565	4.72E07	80.37	77.72
6	10	10	74499	5.45E07	80.37	77.72

Footnotes to Table 12:

1. Field of application of the Bertsche-System-Connectors:
   Structures of glulam or solid wood (coniferous wood),
   each according to DIN 1052-1 : 1988-04 ; solid wood at least sorting class S10 bzw. MS10.
2. The table values **alw_Nt** (allowable tensile stress) are valid without any reduction, if:
   2.1) solid wood sorting class S13 and/or glulam BS14 in the connection area
   of the Bertsche-System-Connectors, **or**
   2.2) solid wood sorting class S10 and/or glulam BS11 in the connection area,
   pins d = 16 mm, max. pin-length 160 mm, without BVD-threaded washers,
   or
   2.3) solid wood sorting class S10 and/or glulam BS11
   pins d = 16 mm, pin-length > 160 mm, with BVD-threaded washers,
   in the first two pin-lines
   (threaded washers type KL35/8 for connector types BVD1 to BVD3 and
   threaded washers type KL45/8 for connector types BVD4 to BVD6) :

allowable tensile stress alw_Nt = alw_Nt according to table 12 ;

3. The table values alw_Nz (tensile stress) have to be reduced by 15%, of the assumptions regarding the wood sorting class / pin-length / threaded washers according to 2.1) or 2.2) or 2.3) are not given :

allowable tensile stress alw_Nt‘ = 0.85 x alw_Nt according to table 12 ;

4. Allowable compression stress :

allowable compression stress alw_Nc = 1.30 x alw_Nt according to table 12 ;

5. In loading-case HZ the allowable force (alw_Nt , alw_Nt‘ , alw_Nc) may be increased by 25% .
6. For transportation-and erection-states the allowable forces (alw_Nt , alw_Nt‘ , alw_Nc) may be increased by 25% .
7. In the case of horizontal impacts according to DIN 1055 part 3 and earthquake loads according to DIN 4149 part 1 the allowable forces (alw_Nt , alw_Nt‘ , alw_Nc) may be increased by 100% .
8. In the case of regard of extreme wind uplift according to DIN 1055 part 4 the allowable forces of the Bertsche-System-Connectors (alw_Nz , alw_Nz‘ , alw_Nd) in loading case H may be multiplied with 1.8 .
9. Pins with or without threaded washers can be applied. The relevant net wood sections are shown in Design Table 12, column No. 6 and No. 7) .
10. The check of the net wood cross-section A_n can be possibly by relevant (with alw_σz = allowable tensile stress of the wood parallel to the fibre) :

Allowable tensile stress alw_Nz = alw_σz x A_n (A_n according to Table 12) ;

11. The ratio of the fullt stressable pin-lengths **L1 : L2** must not exceed the value of **1 : 1,5 ;** pin-lengths L2 exceeding that ratio must not be applied in calculation !

Calculation Example 1:
given: section 6 ½ / 9 ½ in., glulam BS14 .
searched: allowable tensile stress alw_Nt for connector type BVD5 with 10 pins 16 mm x 6 ½ in. and 10 pins 16 mm x 9 ½ in.
solution: alw_Nt (6 ½ / 9 ½) = 0,5 x (alw_Nt (6 ½ / 6 ½) + alw_Nt(9 ½ / 9 ½)) = 0,5 x (38568 lb. + 64193 lb.) = 51380 lb.

Calculation Example 2:
given: section 6 / 6 in., solid wood S10 .
searched: allowable tensile stress alw_Nt for connector type BVD3 with 12 pins 16 mm x 6 in.
solution: alw_Nt (6 / 6) = 24934 lb.

Calculation Example 3:
given: section 7 / 7 in., solid wood S10 .
searched: allowable tensile stress alw_Nt for connector type BVD3 with 12 pins 16 mm x 7 in.
solution: alw_Nt (7 / 7) = 0,85 x 30847 lb. = 26220 lb.
If the four front pins are arranged as threaded pins with BVD threaded washers on both sides, the reduction by 15% is not necessary and it is valid :

alw_Nt (7 / 7) = 1,00 x 30847 lb. = 30847 lb.

Calculation Example 4:
given: section 7 / 7 in., solid wood S13 in the connection area .
searched: allowable tensile stress alw_Nt for connector type BVD3
with 12 pins 16 mm x 7 in.
solution: alw_Nt (7 / 7) = 1,00 x 30847 lb. = 30847 lb.
(no reduction of the Table value, if the solid wood corresponds to the sorting class S13 in the connection area of the anchor)

Glulam: The glulam product is supplied by Alamaco Wood Products Inc. (authorized factory by the JAS a the USA). The glulams are certified by APA EWS Engineered Wood Systems in accordance with ANSI Standard A190.1. A copy of Alamaco Wood Products Inc. Quality Control Manual is on file with the department.

LIMITATIONS OF APPROVAL

Building Code Applicable to Projects Submitted for Review Prior to July 1, 2002: The **Comm** limitations below are in accordance with the current **Wisconsin Building and Heating, Ventilating and Air Conditioning Code:**

The Bertsche System "Concealed Forged Steel Heavy Timber Connection System through a review of structural performance of the concealed steel connections is approved for use under class of construction for "Type 6 Metal Frame/Unprotected" buildings, see **section Comm 51.03(6)**.

Structural:

Installation: Installation of the Bertsche System "Concealed Forged Steel Heavy Timber Connection System shall be in accordance with the manufacturers' published installation instructions and this building product evaluation. If a conflict between the manufacturers' instructions and this building product evaluation occur, the conditions set forth in this product evaluation shall govern.

Identification: All Bertsche System "Concealed Forged Steel Heavy Timber Connection components shall be identified by means of a stamp indicating the manufacturers' name and/or trademark, plant number, the product trade name, and the third-party inspection agency logo.

Drawings submitted for plan review shall include the building product evaluation number 200216-O, component number identification, spans, spacing, loading conditions, bearing details, and other information when required by **s. Comm 50.12** of the current Wisconsin Building Code.

Calculations shall be submitted in accordance with **s. Comm 50.12**. Further, applications not covered by this building product evaluation and requiring special considerations may be handled by contacting Bertsche System's Engineering Technical Support Services staff for guidance.

Glulams used shall be in accordance with **s. Comm 53.61(2).**

The cumulative effects of short-term loads, such as snow, shall be considered in determining the duration of load. For snow load, no greater duration of load factor than 1.15 shall be used.

The design properties are for dry-use conditions and under no circumstances shall the glulams be permanently exposed to the weather.

Bertsche System's descriptive literature indicating glulam composition, dimensions, installation details including locations and details of blocking and bridging (when required), and this building product evaluation must be furnished upon request to code authorities having jurisdiction.

The **IBC** limitations below are in accordance with the **Wisconsin Amended IBC 2000 Code (effective 7/01/02):**

Structural:

Installation: Installation of the Bertsche System "Concealed Forged Steel Heavy Timber Connection System shall be in accordance with the manufacturers' published installation instructions and this building product evaluation. If a conflict between the manufacturers' instructions and this building product evaluation occur, the conditions set forth in this product evaluation shall govern.

Identification: All Bertsche System "Concealed Forged Steel Heavy Timber Connection components shall be identified by means of a stamp indicating the manufacturers' name and/or trademark, plant number, the product trade name, and the third-party inspection agency logo.

Drawings submitted for plan review shall include the building product evaluation number 200216-O, component number identification, spans, spacing, loading conditions, bearing details, and other information when required by **s. Comm 61.31** of the current Wisconsin Building Code.

Calculations shall be submitted in accordance with **s. Comm 61.31**. Further, applications not covered by this building product evaluation and requiring special considerations may be handled by contacting Bertsche System's Engineering Technical Support Services staff for guidance.

Glulams used shall be in accordance with **ss. IBC 2303.12303.1.3**, **2303.1.8**, **2303.1.9**, **2303.2.**, **2304.9.4**, **2304.10.3**, and **2306.1**.

The cumulative effects of short-term loads, such as snow, shall be considered in determining the duration of load. For snow load, no greater duration of load factor than 1.15 shall be used.

The design properties are for dry-use conditions and under no circumstances shall the glulams be permanently exposed to the weather.

Bertsche System's descriptive literature indicating glulam composition, dimensions, installation details including locations and details of blocking and bridging (when required), and this building product evaluation must be furnished upon request to code authorities having jurisdiction.

This approval will be valid through December 31, 2007, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: April 9, 2002 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau

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